Apalachicola River and Bay Watershed Explorations

Apalachicola National Estuarine Research Reserve

Apalachicola National Estuarine Research Reserve
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Research Rangers

Concept

Students will use a scientific process to analyze data from an actual research project at the Apalachicola National Estuarine Research Reserve. Students will report on conclusions and make management recommendations where appropriate.

Objectives

1. Students will understand the positive and negative consequences of human action on the estuary system.
2. Students will understand that humans are a part of the estuary ecosystem and that human activities may deliberately or inadvertently alter the equilibrium in the ecosystem.
3. Students will use these skills to complete their task: Data Analysis and Probability, Graphing, Writing, Public Speaking

Method

In this activity, students will be provided with a research scenario and data from the Apalachicola River watershed to work with in performing a scientific analysis and reporting activity. Students will report on methods, results, and conclusions, and make recommendations for modifications of human impacts on the resources of the estuary.

Grade level: 6th Grade
Subjects: Science, Social Studies, Language Arts, and Mathematics
Location: This activity can be done in the classroom.
Materials: Slide projector or LCD/computer, Projection screen, Paper towels for Enviroscape, Items in the Activity Module
Duration: Two class periods
Sunshine State Standards: Listed on p. 8 of the activity

Introduction:

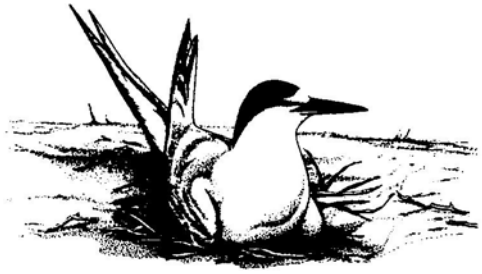
In this activity, students will be provided with a research scenario and data from the Apalachicola River watershed to work with in performing a scientific analysis and reporting activity. Students will report on methods, results, and conclusions, and make recommendations for modifications of human impacts on the resources of the estuary.

Preparation Activities:

1. Review the scientific method with students. Provide auxiliary reading or activities if your students need a better understanding of the scientific method. See the “Resources” list for activity ideas. Review the basic steps of the scientific method with students:

- Observe, identify, and carefully state the problem or question
- State a hypothesis or make a prediction
- Test the hypothesis by collecting data through experimentation or monitoring
- Analyze the data and draw conclusions about the hypothesis
- Report the conclusions so other scientists can test the hypothesis

2. To sharpen the students' knowledge of the scientific method, complete a research investigation using the Enviroscape with the entire class. The teacher can facilitate by leading the class through the steps of the scientific method using the Enviroscape as a scientific research tool.



Getting Ready:

1. Have a research package ready for each team.

Activity:

In this activity students will receive a research package including an Apalachicola research scenario and research **data set**. The student teams will read the scenario, analyze the data, explain the results, decide whether the hypothesis is supported or not, and write a research report. If the conclusions warrant, students may make recommendations for future research or for management actions that will result in positive improvements in the health of the Apalachicola River watershed. This task can be performed by hand, with calculators, or on computers, depending on your teaching preferences.

1. Divide students into working groups of three or four students each. Give each group an Apalachicola watershed research package that is found in the module.
2. Have the students carefully read the research scenario in their package. Each research scenario will describe:
   - The reason for the research, that is, the problem being addressed or the question the researchers would like to answer
   - The hypothesis that the research is seeking to test
   - The research methods and materials used to collect the data
   - The type of data that was collected during the research

   The research scenario may also include other information, such as maps or photographs of the site or species being studied, photographs of the researchers collecting data, etc.
3. Have the students look at the data included with the research scenario. The data will be in table format. The students should be able to clearly see which

variables are being measured and the actual measurements for about 25 to 50 records. Discuss with the students how to read and understand the data table (i.e., identify the variables and values for each variable).

4. At this point, the students will conduct basic statistical analysis of data to test the hypothesis in the research scenario. The students should be able to state the high and low values (the range) for each variable, the middle (median) value for each variable, and the average (mean) value for each variable. The students may also want to find averages for different periods of time or for different geographic zones, depending on the data set. Provide guidance for the data analysis task and encourage students to think about how they might analyze the data to answer the research question.
5. Students should make a graph that includes the two variables in the data set. The graph will allow the students to make a visual comparison of the two variables, to see if they are related or not. Explain to the students that there are more complicated statistical analyses that scientists can perform to compare two variables, but that for the purposes of this project, the students may perform a visual comparison of the graph in an attempt to understand if the variables are related or not. The students might also want to make graphs comparing the average values from different times or sites in their data set. Encourage the students to think of different ways to look at the data.
6. At this point, the students are ready to discuss possible conclusions that can be reached from their data. Have each group discuss the possible conclusions that can be reached from their research results. For example, do numbers of nesting birds decline during certain months? …does water quality get worse after rainstorms? …do fish populations change from year to year as related to some other variable?

Follow-up:

After the students have discussed their results within their groups, the teacher will bring the class together and lead a discussion of the research results. Several groups will discuss their results with the class and will talk about what conclusions they were able to reach. Do the results support the hypotheses or not? Are any of the groups able to develop management recommendations based on the results? The teacher will lead a discussion with the class about the limits of scientific research and how far scientists can go with making recommendations.

During the next class period, each group will develop an outline for their research poster and report. The outline should include the basic parts of a scientific research report:, as shown in the box below. The students might want to look up a scientific report at the library or on the Internet for guidance. At this point, students might also want to

collect additional background information on their research topic or species to include in their report.

Poster Title
Introduction
Methods and Materials for Data Collection
Results
Discussion
Conclusions or Recommendations

Assessment:

Team Assessment: Each team will create a scientific research poster reporting on the results of their study and data analysis. The students should pretend that they are the scientists and that they are reporting at a science fair or professional meeting. The poster should include the basic parts of a scientific research report, as shown in the box above. The poster also should include graphs of the variables. Students may also consider including photographs or maps related to the research, as well as any recommendations supported by the conclusions. Students may also consider including some other facts about the research topic (e.g., natural history of the species, descriptions of water quality monitoring tools, ecosystem descriptions, photographs or maps).

Individual Assessment: Each individual student will write up a scientific research report summarizing the group project. The report should include all of the elements that are included on the poster. The group will share these elements with each other, but each individual student will have the opportunity to format and augment their own report paper as they desire for the individual assessment.

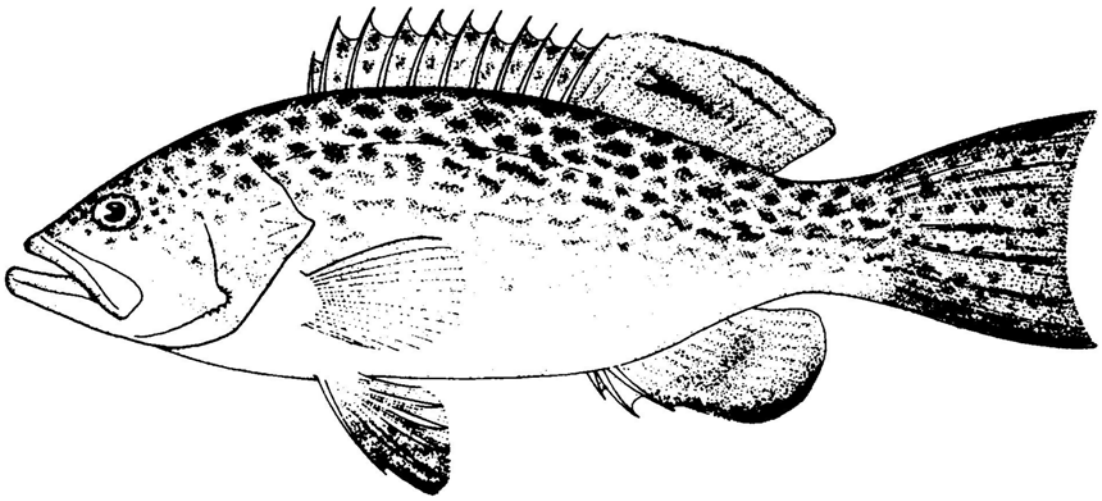
Post Activities:

From a collection of several weeks' of recent newspapers or news magazines, have the students find and cut out articles that represent popular reporting on scientific research results. These articles appear in the newspaper almost every day, so they shouldn't be hard to find. Lead a class discussion about how the reporter has described the scientific research. Do the reporters accurately describe the research results? How do the reporters make the research sound more "interesting" for the popular audience? Discuss the problem of sensationalization or misreporting of research in the popular media.

If more in-depth study is warranted, have the students find an original research report or paper on the Internet and compare it to the news coverage of that research. (Biomedical research topics often have lots of news coverage.) In comparison to the original research, what was included and what was left out of the popular coverage? It is important for science reporters to bring information to the public. How might science reporters do a better job of reporting on research results? Have students write their own news articles from an original research report or paper.

RESOURCES:

- *Science Fair Handbook: Scientific Method*, Discovery Channel School http://school.discovery.com/sciencefaircentral/sciairstudio/handbook/scientificmethod.html
- *Science Project Primer: The Scientific Method*, Science Service http://www.sciserv.org/isef/primer/scientific_method.asp
- *Scientific Method*, BrainPOP (Internet movie for students requires Flash Player) http://www.brainpop.com/science/scientificinquiry/scientificmethod/
- *Energy Fair: Scientific Method*, The NEED Project (Teacher's guide with activities) http://www.eia.doe.gov/kids/cc/EnergyFair2002.pdf
- *Field Guide to the Rare Plants and Animals of Florida*, Florida Natural Areas Inventory http://www.fnai.org/



Background Reading for Research Rangers

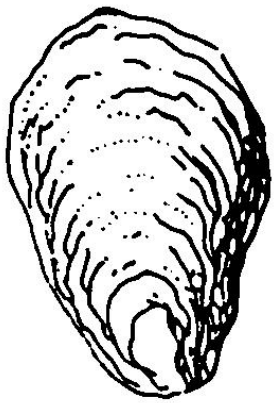
The **scientific method** is a "tool" that scientists use to investigate a scientific problem. The scientific method always begins with **research**. Scientists may use their own knowledge, other scientific resources, or past experiments to identify a problem that has not been explained. Once the **scientific problem** is identified, the problem is stated as a question. The question should be able to be answered through scientific experimentation or observation. Many scientists say that it is very important to be sure that you are asking the right question!

The next step is to formulate a **hypothesis**. The hypothesis is an educated guess or prediction about how the research will conclude. The scientist creates this single statement based on knowledge and past research. The hypothesis will guide the completion of the experiment or way observations are conducted.

It is important to be organized, so a list of **materials** and a detailed description of the **methods** should be developed for every experiment or observation activity. During the experiment, data will be collected on some kind of data sheet or computer. Later, the data will be analyzed through **statistical analysis**. After careful analysis, the experiment or observations will either confirm or deny the **hypothesis**.

At this point, a **conclusion** will be formulated and included in the final report. The scientist also will report on the methods and analysis so that other researchers can duplicate the research, or try the same experiment under different conditions or in a different place. This is an important way that scientists communicate with each other, so that everyone understands what everyone else is doing.

Part of the mission of the Apalachicola National Estuarine Research Reserve is to promote research. The Apalachicola research program provides the setting and equipment to attract and assist researchers. The Reserve tries to direct outside researchers to priority research topics, which address important coastal management issues. The Reserve also has in-house research and monitoring projects to address issues of concern to Reserve managers.



Apalachicola Reserve staff and visiting researchers are involved in a wide variety of research and monitoring programs, including juvenile fish species monitoring in the estuary, sea turtle nest protection and monitoring, listed bird species nest protection and monitoring, continuous water quality monitoring in the bay, and meteorological monitoring.

VOCABULARY

Scientific Method: A method of investigation involving observation and theory to test scientific hypotheses.

Research: To study a scientific problem thoroughly so as to present in a detailed, accurate manner. Research is the first step in the scientific method

Scientific Problem: A question to be considered, solved, or answered. Also known simply as the problem, it is the second step in the scientific method.

Hypothesis: A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation. A hypothesis is the third step in the scientific method

Materials: Tools or apparatus for the performance of a given task. When using the scientific method, it is important to list the materials that are used to conduct the experiment.

Methods: How the experiment was conducted.

Experimentation: The process of testing the hypothesis.

Statistical Analysis: The organization and interpretation of mathematical or factual information used to support or disprove a hypothesis.

Conclusion: The project conclusion is a summary of the results of the project experimentation and a statement of how the results relate to the hypothesis.

Sunshine State Standards Activity Correlations

Science

Processes of Life

Standard 1: The student describes patterns of structure and function in living things. (SC.F.1.3)

SC.F.1.3.1: understands that living things are composed of major systems that function in reproduction, growth, maintenance, and regulation.

How Living Things Interact with Their Environment

Standard 2: The student understands the consequences of using limited natural resources. (SC.G.2.3)

SC.G.2.3.1: knows that some resources are renewable and others are nonrenewable.

SC.G.2.3.2: knows that all biotic and abiotic factors are interrelated and that if one factor is changed or removed, it impacts the availability of other resources within the system.

SC.G.2.3.3: knows that a brief change in the limited resources of an ecosystem may alter the size of a population or the average size of individual organisms and that long-term change may result in the elimination of animal and plant populations inhabiting the Earth.

SC.G.2.3.4: understands that humans are a part of an ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems.

Language Arts

Reading

Standard 1: The student uses the reading process effectively. (LA.A.1.3)

LA.A.1.3.1: uses background knowledge of the subject and text structure knowledge to make complex predictions of content, purpose, and organization of the reading selection.

LA.A.1.3.2: uses a variety of strategies to analyze words and text, draw conclusions, use context and word structure clues, and recognize organizational patterns.

LA.A.1.3.3: demonstrates consistent and effective use of interpersonal and academic vocabularies in reading, writing, listening, and speaking.

LA.A.1.3.4: uses strategies to clarify meaning, such as rereading, note taking, summarizing, outlining, and writing a grade level-appropriate report.

Standard 2: The student constructs meaning from a wide range of texts. (LA.A.2.3)

LA.A.2.3.5: locates, organizes, and interprets written information for a variety of purposes, including classroom research, collaborative decision making, and performing a school or real-world task.

LA.A.2.3.6: uses a variety of reference materials, including indexes, magazines, and journals; and tools, including card catalogs, and computer catalogs, to gather information for research topics.
LA.A.2.3.7: synthesizes and separates collected information into useful components using a variety of techniques, such as source cards, note cards, spreadsheets, and outlines.
LA.A.2.3.8: checks the validity and accuracy of information obtained from research in such ways as differentiating fact and opinion, identifying strong vs. weak, arguments, recognizing that personal values influence the conclusions an author draws.

Writing
Standard 1: The student uses writing processes effectively. (LA.B.1.3)
LA.B.1.3.1: organizes information before writing according to the type and purpose of writing.
LA.B.1.3.2: drafts and revises writing that: is focused, purposeful, and reflects insight into the writing situation; conveys a sense of completeness and wholeness with adherence to the main idea: has an organizational pattern that provides for a logical progression of ideas; has support that is substantial, specific, relevant, concrete, and/or illustrative; demonstrates a commitment to and an involvement with the subject; has clarity in presentation of ideas; uses creative writing strategies appropriate to the purpose of the paper; demonstrates a command of language (word choice) with freshness of expression: has carried sentence structure and sentences that are complete except when fragments are used purposefully; and has few, if any convention errors in mechanics, usage, and in punctuation.
LA.B.1.3.3: produces final documents that have been edited for: correct spelling, correct punctuation, including commas, colons, and semicolons; correct capitalization; effective sentence structure; correct common usage, including subject/verb agreement, common possessive forms, and with a variety of sentence structure, including parallel structure; and correct formatting.

Standard 2: The student writes to communicate ideas and information effectively. (LA.B.2.3)
LA.B.2.3.1: Writes text, notes, outlines, comments, and observations that demonstrate comprehension of content and experiences from a variety of media.
LA.B.2.3.2: organizes information using alphabetical, chronological, and numerical systems.

Social Studies
People, Places, and Environment [Geography]
The student understands the world in spatial terms. (SS.B.1.3)

SS.B.1.3.1: uses various map forms (including thematic maps) and other geographic representations, tools, and technologies to acquire, process, and report geographic information including patterns of land use, connections between places, and patterns and processes of migration and diffusion.
SS.B.1.3.2: uses mental maps to organize information about people, places, and environments.
SS.B.1.3.3: knows the social, political, and economic divisions on Earth's surface.
SS.B.1.3.4: understands how factors such as culture and technology influence the perception of places and regions .
SS.B.1.3.5: knows ways in which the spatial organization of a society changes over time.

Standard 2: The student understands the interactions of people and the physical environment. (SS.B.2.3)
SS.B.2.3.8: knows world patterns of resource distribution and utilization
SS.B.2.3.9: understands how the interaction between physical and human systems affects the current conditions on Earth.

Math

Data Analysis and Probability

Standard 1: The student understands and uses the tools of data analysis for managing information. (MA.E.1.3)
MA.E.1.3.1: collects, organizes, and displays data in a variety of forms, including tables, line graphs, charts, bar graphs, to determine how different ways of presenting data can lead to different interpretations.
MA.E.1.3.2: understands and applies the concepts of range and central tendency (mean, median, mode).
MA.E.1.3.3: analyzes real-world data by applying appropriate formulas for measure of central tendency and organizing data in a quality display, using appropriate technology, including calculators and computers.

Standard 3: The student uses statistical methods to make inferences and valid arguments about real-world situations.
MA.E.3.3.1: formulates hypotheses, designs experiments, collects and interprets data, and evaluates hypotheses by making inferences and drawing conclusions based on statistics (range, mean, median, and mode) and tables, graphs, and charts.